Aflasafe® technology transfer and commercialisation in Africa

Country status: Nigeria

September 2020

Nigeria's aflatoxin challenge

Aflatoxin is a poison produced by a naturally occurring fungus, and leads to liver cancer and child stunting. Livestock have not been spared, and aflatoxin effects are deadly and costly.

Aflatoxin

is a natural **cancer-causing poison** from toxin-producing types of the *Aspergillus* fungus. Because aflatoxin **contaminates food**, the effects of aflatoxin build up in our bodies and damage our health. As well as **causing liver cancer**, aflatoxin makes us weaker against other diseases and stunts children's growth. In some cases, aflatoxin in food can be fatal.

In large amounts, aflatoxin can make us ill or kill straight away (acute aflatoxicosis). But most of the time, we eat it without noticing. It can therefore gradually **infiltrate our bodies**, with its effects building up within us (chronic aflatoxicosis). For this reason, aflatoxin can be present undercover for many years doing us long-term harm, **yet very difficult to detect**. As with all ills, the best cure is prevention.

Geography	***Area:*** 923,763 km^2 ***Agroecology:*** Sahel, Sudan, Northern Guinea, Southern Guinea, Mangrove and Coastal zones ***Neighbours:*** Benin, Cameroon, Niger, Chad
Population	195.9 million, with 12.3 million in farming
Agriculture and Economy	
GDP	USD 375.8 billion, with agriculture accounting for 21.2%
Main crops	Rice, maize, groundnuts, cowpeas, cassava, millet, sorghum, cocoa, sesame, yams

Food consumption

	% of households consuming	Annual *per capita* consumption (kg)
Maize, rice, sorghum	98.5	18, 35, 40
Chicken and eggs	97.4	30, 1.7
Legumes and nuts	91	27, 10

Crop production and utilisation

Total arable land available for agriculture is estimated at 34m hectares. Agriculture is mainly rainfed, with only 1.0% under irrigation.

	Area cultivated (million hectares)	Average output (million metric tonnes)
Sorghum	6.1	6.8
Maize	4.8	10.1
Groundnuts	2.9	2.8

	Utilisation		
	Food	*Feed*	*Processed*
Maize	55%	31%	14%
Sorghum	70%	15%	15%
Groundnuts	85%	10%	5%

Sources: *Nigeria Bureau of Statistics, Nigeria Data Portal, United States Department of Agriculture, Nigeria Grain and Feed Annual Report, World Bank*

A 2016–2018 Total Diet Study by the National Agency for Food and Drug Administration and Control (NAFDAC) found alarming levels of aflatoxin in staples produced, traded and consumed in Nigeria. Samples of maize, groundnuts and groundnut oil from key markets in Kano and Lagos (the largest cities in the north and the south) had very high levels of aflatoxin B1, at 66 parts per billion (ppb) in groundnuts, 15 in oil and similarly high levels in maize. Aflatoxin B1 is the most toxic type of aflatoxin. And so, while Nigeria's limit for total aflatoxin is a maximum of 4 ppb, aflatoxin B1 has a higher individual standard of 2 ppb. And while groundnuts and maize are particularly susceptible to aflatoxin, so too are ginger, chilli peppers and sorghum.

A Country Situation Study by the African Union's Partnership for Aflatoxin Control in Africa (PACA) reported that Nigeria loses about USD 155 million in trade opportunities for failing to comply with international aflatoxin standards. Even more worrying, PACA estimates that each year, 5,000 Nigerians lose their lives due to liver cancer, making aflatoxin contamination an unquestionable major health and trade challenge nationwide, as crops, food and food products freely move right across Nigeria's expansive length and breadth, in addition to local consumption. And so, since food consumption does not mirror regional production, effective aflatoxin safety is a nationwide concern that must also be tackled and coordinated at that same national level, and not just at regional and State level.

What have IITA and partners done about it?

After years of research in close collaboration with the University of Ibadan, the University of Bonn (Germany) and the United States Department of Agriculture–Agricultural Research Service, the International Institute of Tropical Agriculture (IITA) developed a natural product, Aflasafe™, to counter aflatoxin contamination in key foods. Applied pre-harvest but having significant postharvest benefits, Aflasafe effectively reduces aflatoxin contamination by as much as 98% in the field and in storage for maize and groundnuts.

Aflasafe

Aflasafe™ was registered in 2014 for use in Nigeria to counter aflatoxin in maize and groundnuts. Aflasafe is **a safe natural solution** to the problem of aflatoxin, **homegrown in Africa** through national and international collaboration. It works from the plot to your plate to **stop contamination from reaching dangerous levels** and keep foods like maize, groundnuts and sorghum **safe to eat**.

Aflasafe tackles toxic tragedy using harmless types of *Aspergillus flavus*. Surprisingly, this is the same kind of fungus that produces aflatoxin, but in this case they are kindlier cousins that **do not and cannot ever produce the toxin**.

Each country has its own version of Aflasafe using a mixture of four fungal strains, all found growing naturally in local soils. The friendly fungi are coated onto ordinary sorghum grain, which acts as a vehicle to help them get established, and can easily be broadcast onto fields.

Aflasafe is dyed blue using food colour, to distinguish Aflasafe from sorghum to eat. Aflasafe has the highest World Health Organisation standard for safety.

IITA's Aflasafe Technology Transfer and Commercialisation (ATTC) is an initiative to broadly disseminate the Aflasafe technology. We started with a commercialisation strategy to guide our intervention in the country, based on the potential market, the feasibility of local manufacturing and distribution, the policy environment and the investor landscape. The strategy defined the key partners and interventions necessary. ATTC then vigorously engaged with private-sector actors, leading to the selection of Harvestfield Industries Limited as the licensed partner to undertake Aflasafe production, marketing and distribution on a commercial basis across the country. For successful and seamless integration of Aflasafe into Harvestfield's product portfolio, ATTC provides continuous and customised on-going technical and advisory support in critical areas such as factory design and set-up, marketing and educational communication materials in major Nigerian languages, business and market development, and advocacy and partnership building. This includes product improvement, such as the dry-inoculum innovation unveiled in 2019 that is making a huge difference for Aflasafe's in-country production, by significantly saving running costs for Aflasafe manufacturers while however not compromising quality whatsoever.

But our engagement is not limited to the private sector. Right from product development and testing, IITA worked very closely with NAFDAC, and thereafter also increasingly with the Federal Ministry for Agriculture and Rural Development (FMARD) on public awareness and product distribution once Aflasafe was registered. In addition, Aflasafe's excellent performance has attracted and retained private-sector interest as clients and returning customers, beyond manufacture and distribution.

Harvestfield Industries Limited

Harvestfield Industries Limited was founded in 2000, commencing business in 2001, mainly in crop protection products (CPPs), importing and distributing agrochemicals and agricultural spraying equipment.

Aflasafe has a natural home at Harvestfield, neatly fitting into the company's signature CPP portfolio.

Harvestfield also represents international companies in Nigeria such as Bayer, Dow, BASF and East-West Seeds, and has entered joint ventures with external partners. Harvestfield has 18 field offices/warehouses in all of Nigeria's six geo-political zones.

Aflasafe contributes to two of the United Nations Sustainable Development Goals.

SUSTAINABLE DEVELOPMENT GOALS

Main milestones in commercialising Aflasafe in Nigeria

2017
- Harvestfield commences Aflasafe distribution
- First Aflasafe sale to public sector through FMARD

2018
- IITA appoints Harvestfield as licensed Aflasafe manufacturer and distributor in Nigeria

2019
- Aflasafe sales surpass 1,000 MT, with bulk of sales to private sector
- Harvestfield identifies location and commences procuring equipment for its Aflasafe factory in and for Nigeria

2020
- Factory construction commences
- Harvestfield creates Strategic Business Unit to drive Aflasafe commercialisation

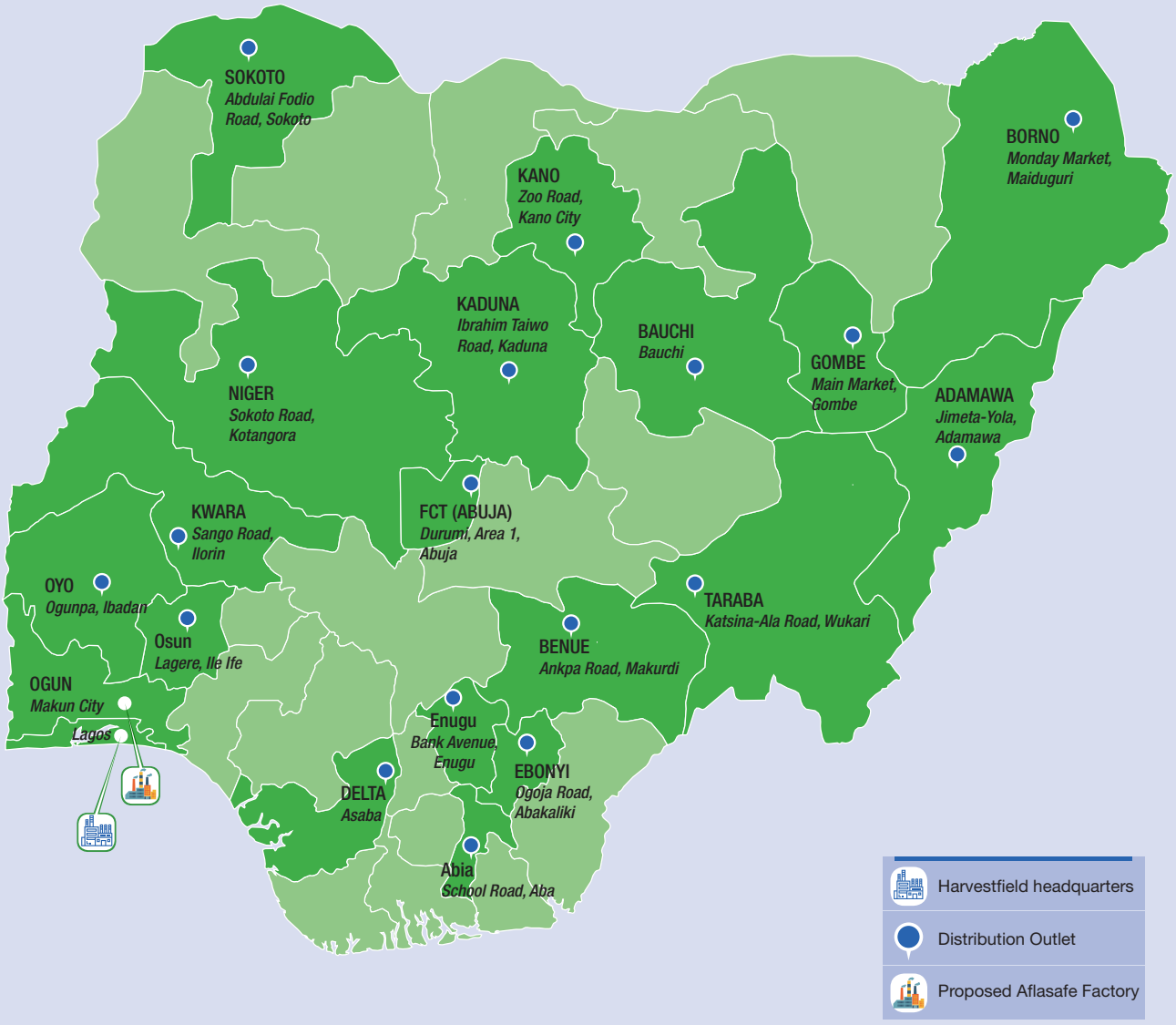
Key commercialisation partners

- Federal Ministry of Agriculture and Rural Development (FMARD)
- Nigerian Export Promotion Council (NEPC)
- Olam Nigeria
- Dangote Farms
- Acirfa Shipping International
- GIZ Green Innovation Centre
- HarvestPlus
- Partnership for Aflatoxin Control in Africa (PACA)
- National Agency for Food and Drug Administration and Control (NAFDAC)
- Maize Association of Nigeria (MAAN)
- National Groundnut Producers, Processors and Marketers Association of Nigeria (NGROPPMAN)
- The Jigawa State Government

Aflasafe sales in Nigeria

As of January 2020, Harvestfield had sold more than 1,600 metric tonnes (MT) of Aflasafe to a gradually increasing clientele comprising private-sector agribusinesses, local commodity associations such as the North-East Commodity Association, and government institutions, with FMARD being the main buyer, for dissemination throughout the country through the Ministry's Green-houses. And to further assure last-mile availability of Aflasafe, Harvestfield's newly created Strategic Business Unit will now integrate agro-input dealers into its distribution network. Harvestfield has thus far invested USD 2m on land and equipment for the Aflasafe factory, whose construction and commissioning is slated for 2020.

Harvestfield distribution points, and Aflasafe factory location



ATTC works in close collaboration with other critical stakeholders to increase awareness of aflatoxin, and to stimulate and sustain the use of Aflasafe in the country, alongside other aflatoxin mitigations and good agricultural practices. For example, GIZ's Green Innovation Centre trained agricultural extension agents from across Nigeria on Aflasafe application and integrated aflatoxin management from farm level to storage. Through PACA, ATTC has contributed to fostering and stimulating much-needed policy reforms in food and agriculture, to assure safe food for all Nigerians.

But also to practice, and to changing standard operating procedures for the private sector. Since 2018, small, medium and large businesses have used Aflasafe™ – the customised product for Nigeria – to manage aflatoxin. The results have been spectacular, opening doors to high-end food processing markets, as well as export to Europe. For some of these clients for whom reputation, quality, consistency and aflatoxin-safety all constitute the make or break in their business, Aflasafe has consistently reduced total aflatoxin to below 2 ppb – less than half of the maximum 4 ppb threshold for the European Union (EU). Moreover, these local results at product source in Nigeria have each time been validated by independent testing by EU authorities at the point of entry in destination markets.

What remains to be done?

A lot, in Africa's most populous nation, and Aflasafe's largest potential market, that is also – through its Green Alternative – continuously, arduously and aggressively promoting non-oil revenue through significant investments in agriculture.

Effective aflatoxin control is a 'shared responsibility', calling for concerted collective action by all. The government is indispensable.

Food safety is not as rigorously regulated as it should be. Therefore, the private sector should send a strong signal to farmers and intermediaries by rewarding quality. The government should not only formulate but also enforce appropriate food-safety policies and regulations. Effective collaborative action by the public and private sector to sensitise value-chain actors and consumers would increase the demand for safe food, and thus, for Aflasafe.

Nigeria has an estimated 7 million hectares devoted to groundnut and maize cultivation every year, but only 170,000 hectares have so far been treated with Aflasafe. Chronic humanitarian crises in the North-East region have greatly increased the demand for aflatoxin-safe food. These crises include severe acute malnutrition (SAM), making ready-to-use therapeutic food (RUTF) absolutely critical. The United Nations Children Fund (UNICEF) estimates that more than a million Nigerian children suffer SAM annually, and require more than 10,000 MT of RUTF each year. Local RUTF production is hindered by lack of high-quality, aflatoxin-safe groundnuts – the primary RUTF ingredient.

Aflasafe should be extended to other crops. The Federal Ministry of Trade and Industry reports increasing rejection of commodities such as ginger and chillies due to dangerous aflatoxin levels.

Key barriers limiting broad Aflasafe use and assurance of aflatoxin-safe food include:

- *Low consumer awareness* of the health hazards and risks from aflatoxin-contaminated food.
- *Lack of market incentives* such as higher prices for aflatoxin-safe produce, which would encourage even more farmers to use Aflasafe.
- *Low aflatoxin-testing capacity* and high costs of mobile testing kits.
- *Poor enforcement of aflatoxin standards* in grains and food by regulatory bodies.
- *Lack of resources* for mandatory field trials necessary for the regulatory extension of Aflasafe to other crops.

ATTC has been working with partners to address some of these barriers in order to ensure market-driven Aflasafe sales and sustainability. Proposed interventions include:

- ***Expanding Aflasafe application:*** With the growing discovery of significant aflatoxin levels in other crops such as ginger, sorghum and chillies, Aflasafe product research is imperative for these high-risk crops, as well as concomitant business development and market segmentation for these new market sectors for Aflasafe.
- ***Public policy engagement, and expanded testing:*** The passage of a National Food Safety Bill which will legislate aflatoxin levels and serve as a basis for strict enforcement of food-safety standards in Nigeria has become a critical policy imperative. IITA in conjunction with HarvestPlus and FMARD were instrumental in the formulation of this Bill, having held a maize quality dialogue in 2018. IITA proposes to continue working in close conjunction with PACA, NAFDAC and other institutions to scale out and intensify advocacy for the passage of the Bill. A vital component of public-policy engagement and regulation is the need to build – or strengthen – the aflatoxin-testing capacity of government regulatory agencies. IITA proposes to lead this effort by providing training on rapid testing for relevant agencies – an area in which IITA has international scientific expertise.
- ***Public awareness and sensitisation:*** IITA proposes to work in close collaboration with the Federal Consumer Protection Commission and the Global Alliance for Improved Nutrition (GAIN), and others, to conceptualise and implement a Nationwide Aflatoxin Sensitisation and Awareness programme for the country, targeting the consumer public.
- ***Value-chain approach for integrated aflatoxin management:*** scaling the availability of aflatoxin-safe food will require improvement in the national food system. This will in turn require increasing the use of appropriate technologies and practices along the entire value chain. IITA has the capacity, network and experience to help achieve this, by mobilising critical institutions like the Federal Department of Extension and NAFDAC to build the capacity of smallholder farmers, commodity aggregators, and traders and processors, in good pre-harvest and post-harvest handling practices and the use of appropriate technologies.

The implementation of the four-point strategy above is a critical next phase for IITA and other partners working to address the aflatoxin challenge in Nigeria. It requires broad-based partnerships with the national and State governments, private-sector players and development partners. IITA has capable research and business-development teams that would deliver the expansion of aflatoxin mitigation to other crops and market sectors.

ATTC Aflasafe
Safer food in Africa

Implemented by:
IITA Transforming African Agriculture
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